

## Thoracic Outlet Syndrome

### I. Background

The thoracic outlet syndrome (TOS) is a potential cause of neck, arm, and/or hand pain. TOS is more common among women than men and occurs most frequently in the 2<sup>nd</sup> through 4<sup>th</sup> decades. The thoracic outlet is located at the superior aspect of the thorax; neural and/or vascular compression attributed to the thoracic outlet syndrome has been described as occurring up to 9 anatomic locations, with the three most common being (a) the interscalene triangle, (b) between the first rib and the clavicle, and (c) between the pectoralis minor and thoracic cage. Risk factors include anatomic anomalies (cervical rib, long transverse process at the cervical spine, clavicle fracture or anomaly, bifid first rib or fusion of the 1<sup>st</sup> and 2<sup>nd</sup> ribs, tumor, subclavian artery aneurysm, etc.), trauma, or occupations requiring prolonged, static shoulder protraction postures and/or frequent shoulder abduction activity such as reaching or lifting over shoulder height.

This diagnosis often requires consultation by a specialist (neurologist, neurosurgeon, orthopedist, physiatrist, or vascular surgeon). Treatment is non-surgical in the majority of cases, but surgical decompression of the brachial plexus and/or vascular structures may be required in some instances.

### II. Diagnostic Criteria

#### A. History and Physical Examination

Patients most commonly complain of supraclavicular shoulder pain with radiation to the medial arm and forearm, often with numbness and/or coolness in the 4<sup>th</sup> and 5<sup>th</sup> digits of the hand. Hand weakness or difficulty with fine manipulation may be reported, as well as cold intolerance. Cervical motion may increase symptoms, and headaches may develop. A cool, pale hand or swollen upper extremity may be reported. Symptom duration ranges from weeks to years, with an average of 18 months. Ten percent of patients have bilateral hand symptoms. Differential diagnosis includes carpal tunnel syndrome, ulnar neuropathy, cervical radiculopathy, medical epicondylitis, fibromyalgia, CRPS-1, axillary vein thrombosis, subclavian steal syndrome and/or apical lung tumor.

Physical examination should include a complete orthopedic and neurovascular examination, with attention to: sensation, reflexes, strength, range of motion, muscle atrophy and pulses. Specific diagnostic tests include:

1) Adson's maneuver, in which the shoulder is abducted and externally rotated with the neck extended, and the radial pulse is palpated. A positive test includes a decrease in the radial pulse pressure.

2) Wright's maneuver, in which the shoulders are abducted and externally rotated, as the patient inhales deeply and holds his/her breath. A positive test includes a reproduction of paresthesias in the symptomatic distribution.

3) Roos test, in which the shoulders are fully flexed, and repetitive, rapid finger flexion and extension are performed. A positive test includes a reproduction of paresthesias in the symptomatic distribution.

B. Diagnostic test procedures include:

1) X-rays of the cervical spine, to rule out cervical rib and/or apical tumor.

2) Electrodiagnostic studies including nerve conduction testing and electromyography. A prolongation of the ulnar F wave and/or a decrease in the ulnar sensory nerve action potential (SNAP) may be seen.

3) MRI of the cervical spine and/or brachial plexus may rule out cervical disc herniation or a space-occupying lesion (tumor, cyst, abscess, etc.)

4) MRA or arteriography with the arm in abduction may demonstrate compression of the supraclavicular vasculature.

### III. Treatment

A. Non-operative

1) Physical therapy/occupational therapy, with application of a specific exercise protocol. Scapular retraction (passive and active) and cervical active range of motion exercises are generally included.

2) Avoidance of carrying heavy objects; avoidance of persistent and/or repetitive activities with the shoulder flexed and/or abducted.

3) Medication: analgesics, NSAIDs, tricyclics, muscle relaxants and/or anticonvulsants

B. Operative

1) Surgical resection of a segment of the first rib

2) Scalenectomy or removal of cervical rib or rudimentary rib via a supraclavicular approach

### IV. Estimated Duration of Care

Non-operative care options are indicated prior to consideration of operative treatment. Non-operative care may be provided for at least 8 weeks prior to considering surgery, and may be continued until the point of maximum medical improvement.

Operative treatment, followed by a post-operative treatment phase of up to six months' duration, should lead to a point of maximum medical improvement in most cases.

Protocol History:

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